

There are 4 problems on this exam. Carefully read and follow all directions. In order to receive credit show all necessary work. No credit will be given for an answer I cannot find or cannot read. All answers should be exact unless specified otherwise.

1. Determine the indicated information for the quadratic function  $f(x) = 2x^2 + 20x - 65$ . (30 points)

Vertex \_\_\_\_\_

Shifted Form \_\_\_\_\_

Domain \_\_\_\_\_

Range \_\_\_\_\_

$y$ -intercept \_\_\_\_\_

$x$ -intercepts \_\_\_\_\_

To graph  $y = f(x)$  how should we shift the graph of  $y = 2x^2$ ?

Does this parabola open upward or downward?

$f(x)$  is increasing for  $x$  in the interval(s) \_\_\_\_\_ and decreasing for

$x$  in the interval(s) \_\_\_\_\_

2. The revenue generated from selling  $x$  units of a product is given by  $R(x) = -7x^2 + 1722x$ . Determine the following. (4 points each)

(a) What is the revenue if 25 units are sold?

(b) What quantity  $x$  will generate the maximum revenue?

(c) What will be the maximum revenue generated?

(d) In business you want revenue to be positive. Based on this fact, what should the restricted domain for this revenue function be?

3. (a) Explain why a linear model should not be used to describe the following data points. (3 points)

Speed	Miles Per Gallon
30	21
35	21
50	37
55	43
70	41
75	28

- (b) Based on the scatterplot for this data what is an appropriate model? Calculate the appropriate model and record your answer below. Round values to the nearest hundredth. (4 points)

Type of Model: \_\_\_\_\_  $y =$  \_\_\_\_\_

- (c) What is the value of  $r^2$  for the model in part (b)? Round your answer to four decimal places. (2 points)
- (d) Use your model to estimate the miles per gallon for a speed of 40? Round the value to the nearest whole number. (3 points)
- (e) Show me the graph of the regression curve and the data points in an appropriate window on your calculator. (3 points)

4. Let  $f(x) = 27x^4 - 15x^3 - 218x^2 + 120x + 16$ .

(a) Apply Descartes' Rule of Signs to  $f(x)$  to determine the number of positive and negative real zeros  $f(x)$  can have. (6 points)

(b) List the possible rational zeros of  $f(x)$ . (6 points)

(c) Calculate  $f(-1)$  and  $f(0)$ . (4 points)

$$f(-1) = \underline{\hspace{2cm}}$$

$$f(0) = \underline{\hspace{2cm}}$$

(d) The answers in part (c) guarantee a zero of  $f(x)$  between  $-1$  and  $0$ . This is a consequence of what theorem? (3 points)

(e) Knowing  $f(x)$  has a zero between  $-1$  and  $0$ , what numbers should you check to determine if this zero is rational? (4 points)

(f) Graph  $y = f(x)$  in the window  $XMIN = 0$ ,  $XMAX = 2$ ,  $YMIN = -1$ ,  $YMAX = 1$  on your calculator. What does this graph tell you about the multiplicity of the zero between  $0$  and  $2$ ? (3 points)

(g) Determine all of the zeros of  $f(x)$  and write  $f(x)$  in completely factored form. Show any necessary synthetic division. (16 points)